A RETROSPECT

OF

THE PROGRESS

OF

MICROSCOPIC INVESTIGATION,

AND OF

THE MORE IMPORTANT RECENT CONTRIBUTIONS TO NORMAL AND PATHOLOGICAL HISTOLOGY.

(13)

BY

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RETROSPECT,

&c. &c.

Of the several methods of investigation by which, during this, the first half of the nineteenth century, the science of medicine has been advanced, and so many important additions have been made to our knowledge as well of normal structure and function, as of the several lesions which are produced in both by disease, not one is entitled to more serious attention at the hands of the physiologist, the pathologist, and the practical physician, than that which reveals to us, by the aid of the microscope, the ultimate configuration and arrangement of the particles of the most complex tissue, and resolves into elements the most dissimilar what to the naked eye appears a homogeneous fluid.

While we acknowledge the deep debt of obligation which our science owes to the researches of the chemist, and fully appreciate the value of his labours, we cannot but think that the extensive and vigorous prosecution of microscopic investigation is destined to confer equally signal benefits on medicine. A retrospective glance at what has been already achieved in this department would appear sufficient to convince even the most sceptical; but it is to be regretted that an irrational conservatism, and opposition to what is new, with a profound veneration for all that the past has transmitted to us, are too often active and watchful to throw a barrier of hostile prejudice in the way of those who are bold enough to break new ground. We find that, even on the Continent, very recent writers have thought it necessary to enter at some length into the consideration of the claims which the microscope has on our attention, though neither amongst our French nor German neighbours can its application to scientific medical investigation be considered as new(*a*).

(*a*) Traité du Microscope, &c., par le Dr. Ch. Robin. 8vo. Paris, 1849, pp. 79, *et seq.* The following passage is deserving of attention:—

"Il n'y a, comme on le voit, dans tout ce qui précède, rien de plus que ce que nous étudions dans les autres corps, ce sont les mêmes charactères, les mêmes propriétés; il n'y a de nouveau que le maniere de les observer, qui n'est elle même qu'une modification de nos moyens ordinaires d'observation appropiées à leur petit volume."—p. 78.

And yet, if we are to believe in a gradual progress towards the perfection of our art, the new must be ever looked for, and its advent should be hailed with gladness; not, however, that it may supersede the old, as proclaimed by many of its too zealous advocates with an exaggerating enthusiasm, perhaps never wholly separable from the introduction of a new dogma; but that, with new aids superadded to the means we are already in possession of, we may be the better able to undertake the investigation and solution of difficulties that have hitherto baffled our best energies. And who is there so confident in the powers of his art, that will venture to assert that it needs no amelioration, that it has reached its point of culmination? If there be such, let him reflect on the many occasions that the most scientific principles of diagnosis have failed to detect an existing lesion, that the most judiciously directed treatment has been unsuccessful; let him but look on the long category of nervous diseases, and sum up the amount of his knowledge of their causation and their pathology, or the value of his skill in their treatment.

Though our preface be apologetic, it can hardly be deemed superfluous, especially in the pages of an Irish periodical, issued from the Irish school where every department of medicine is represented, and cultivated with success, save one, and that one, as we firmly believe, destined to exercise a powerful influence on our views of the most abstract as well as the most practical questions. We believe that we are justified in saying that no original communication of any importance has been made to histology, or any collateral branch of microscopic investigation, by an observer from the Irish school; though, as we are fully aware, many of our physicians and surgeons have occupied themselves in verifying the observations of others, and in no few instances have acquired practical skill in the employment of this instrument, and made useful applications of the results thus obtained in the practice of their profession(*a*). It may, however, be anticipated, that before long the attention of the Irish school will be fully awakened to the importance of the subject, and that many will be found amongst us ready and willing to engage in this interesting department of medical investigation. Our object in the present retrospect has been as much to bring the subject prominently forwards, as to give a succinct though brief account of some of the more remarkable contributions to histology, which have been recently made in the English and Continental schools. The limited space which can be afforded to communications like the present in a journal so fully occupied as

(*a*) It is well known to most of our readers that the late Dr. John Houston, of this city, occupied himself very assiduously at microscopic investigation. Drs. Carte, Aldridge, Hill, Moore, Steele, Fleming, &c. &c., possess good instruments and are excellent observers. The last-named gentleman made an interesting communication, on the subject of urinary deposits, to the Surgical Society, at its last meeting, and has on many occasions favoured us with opportunities of examining the urine in several abnormal conditions.

this with subjects of a more directly practical nature, prevents us from giving as complete a resumè of the state of microscopical science as we could wish; it is to be hoped, however, that the several contributions to histology that we are about to bring under consideration will be found both interesting and important.

The systematic treatise of Quekuett, which was brought under review in a former number of this Journal, enters so fully into the consideration of the mechanical arrangements of the microscope, that we feel it unnecessary to do more at present than refer to its pages such of our readers as may be anxious to learn any particulars of manipulation. A work of somewhat similar scope has been published(*a*) by M. Chas. Robin, author of the treatise "Des Végétaux qui croissent sur l'Homme et les Animaux."

Though it is no part of our present intention to describe either the microscope itself or any of its accessory apparatus, we shall borrow from the treatise of the latter author some practical hints which may be of value to those who are actually engaged in making investigations. The experience of M. Robin is directly opposed to the opinion maintained by some, that the prosecution of microscopic investigation is injurious to the organs of vision, and he does not hesitate to say, "Depuis Leuwenhoëck, qui conserva d'excellents yeux jusque dans une extrême vieillesse, tous ceux qui se sont beaucoup servis du microscope s'accordent sans exception à reconnaître que jamais ils n'ont ressenti le moindre trouble visuel." If we but reflect, as this author remarks further on, that the light of the microscope is, for the low powers, scarcely greater than that of the sky or a lamp, by reason of the small degree of concavity of the reflecting mirror, and that, as we raise the power of the object-glass, the amount and intensity of the light diminish proportionably, we see no reason why the habitual use of the microscope should tend to injure the visual apparatus. At all events, there is no ground for supposing that the eyes would be more liable to injury from this use of them, than from constant reading or writing, which are equally fatiguing occupations.

Amongst the embarrassments which the inexperienced microscopic observer meets with (they have occurred over and over again to the writer), may be enumerated his mistaking for constituent parts of the object he is investigating, the several flaws, scratches, and innumerable imperfections of the ordinary glass slides, as also the presence of dust and extraneous matter. Occasionally, when the eye is brought very near the eye-glass during a protracted and careful examination, the movement of the lids throws the eye-lashes in front of the pupil, and they assume the appearance of large filaments crossing the field. But a source of error much more likely to escape detection will be found in the so-called *globules and filaments of the eye*, which do not depend on a too strong impression of the retina by the rays of light, as supposed by some, but will

(*a*) Du Microscope et des Injections, par le Dr. Ch. Robin. 8vo. Chez J. B. Baillière, à Paris, 1849.

be found to exist in both eyes of every individual who looks through the microscope, being subject to certain varieties in different persons. We are indebted to M. Robin(*a*) for a very satisfactory account of this phenomenon, of which we purpose freely to avail ourselves. When we examine the field of the microscope, without placing an object in focus, a mass of small, perfectly round globules, all nearly equal in size, may be observed. They cover all parts of the field, except about a sixth externally, and a space somewhat smaller within. Two or three tortuous very pale filaments are seen a little external to the centre of the mass of globules, a few of the latter adhering to them. The mass of globules is limited without by a flattened line or filament, somewhat brilliant in the centre, appearing of the size of a demi-millimetre, and either straight or slightly curved. Within it is limited by a filament more brilliant than the preceding, and remarkably flexuous, and folded on itself. *All the globules and filaments move together.* There appear to be two planes of globules, the one nearer to the eye with sharper outline; the other deeper, paler, more distant, and with their borders more undefined. These two planes sometimes move in opposite directions, but only through a small space, and quickly resume their places. They are in constant motion, and may be ascertained to obey the movements of the head of the observer, remaining stationary when the latter is fixed for an instant with both hands. The filament which limits the mass of globules externally can be brought to the centre of the field, and it may be then seen that there is a certain number of globules placed outside it. The internal tortuous filament can also be removed, and then external to it will be seen one or two other filaments, equally tortuous and brilliant, directed obliquely towards it. The globules are perfectly round, close to each other, and appear about a demi-millimetre in diameter. They present in the centre a brilliant point, surrounded by a dark, well-defined circle, which is itself surrounded by a second and last external concentric ring, as brilliant as the central point. Those of the deeper plane differ only in being less defined, some of them are in contact with, and impinge on one another, so that their dark borders touch. Besides these globules, some persons see others, larger and more transparent, which do not always occupy the same place in the field of vision. The external straight filament is brilliant in the centre, the borders being more obscure and less defined; it appears about one or one and a half millimetres in size, no globules adhere to it, and it is impossible to say whether it is hollow or full. The internal filament differs from the preceding only by its flexuosity, which causes it to occupy more space in breadth but less in length, and makes it more evident when brought to the centre of the field. The filaments placed amongst the globules are much more narrow than the preced-

(*a*) This writer informs us that M. Donné, in his Cours de Microscopie, Paris, 1844, in 8vo., has given a very elaborate description of these globules and fibres. See also Atlas de Cours de Microscopie, Paris, 1845, in fol. pl. xx. fig. 83.

ing, they are two or three in number, tortuous, and about the length of a quarter of the field. They are not always so readily perceived as the larger ones, their borders being less marked, and less brilliant, at the same time that the globules encircle and appear to adhere to them. These globules are ordinarily disposed in pairs, and in contact one with another, each pair, however, being separated from the next by a certain interval.

It is unquestionably of the highest importance that we should be able to distinguish these little bodies from any part of the object we are examining; and, in general, no difficulty whatever will be experienced in doing so. When we consider that they follow the motions of the head, and are not affected by changing the positions of the glass slides, or by any movements communicated to the stage, we see at once that they must be referred to the eye of the observer. Hence the necessity on the part of the latter of making himself thoroughly acquainted with their figure, position, and the peculiar modification which they may possibly be subject to in his own person. They have been, and may be, to many a source of painful apprehension and uneasiness, giving rise to the opinion that the organs of vision were threatened with disease. It cannot, therefore, be too generally made known, that the phenomenon is one experienced by all who make examinations with the microscope; that the conditions which produce it are universal; and that there is no reason for fearing that cataract, or amaurosis, will be the reward of patient and protracted microscopic investigation. As to the cause of these *globules and filaments of the eye* being seen under the microscope, much difference of opinion still exists. M. Robin appears to agree with M. Donné in thinking, that it is in the liquor Morgagni we must look for their real seat; it would appear to us, however, more probable that they are due, as remarked by Wallace, to the filaments and globules which the investigations of Pacini, Treviranus, Hanover, and others, have proved to exist in the retina. We consider it quite possible that the posterior wall of the eye may reflect light, and thus give an image of itself, in the same manner that objects are seen in the bottom of a river through the water; that in fact the eye may perform the triple office of twice transmitting light, bringing it to a focus, and seeing it.

The work of Mr. Quequett contains a very excellent description of several varieties of micrometers, and gives judicious rules for the estimation, by their assistance, of the value of the magnifying powers of the different object-glasses.

The two processes hitherto most frequently in use on the Continent are, according to M. Robin, *the method of the camera lucida and of double vision;* which consists in throwing, by means of a camera lucida, the magnified image of an objective micrometer (whose subdivisions are known) on a rule divided into millimetres, placed at the distance of distinct vision. By noting how many millimetres on the latter are covered by each hundreth of a millimetre of the micrometer, the magnifying power is thus found directly. The second process consists in looking with one eye at the subdivisions of an

objective micrometer placed under the microscope, while with the other we regard the divisions of a rule or the points or a compass. The images of the two objects, painted separately on each eye, are thus superposed one on the other in the nervous centres ; and with a little habit, it may be easily ascertained how many of the subdivisions of the rule are covered by a single division of the magnified micrometer.

Several sources of inaccuracy are stated by M. Robin to exist in both these methods, these he has detailed at length in his work(*a*); and he has accordingly proposed the following *method by the ocular micrometer*, which appears to answer all requirements, both as to simplicity and accuracy. It consists in employing an ocular micrometer, the superior glass of which magnifies exactly ten times. The micrometer placed in the focus of the superior glass of this ocular is one centimetre or half a centimetre, of which each millimetre is divided into ten parts. These tenths of a millimetre, being magnified ten times, equal each a millimetre. It is consequently a decimetre, or a demi-decimetre, each of whose subdivisions is equal to a milimetre, which is placed permanently in the ocular. Consequently, if an objective micrometer be placed under the microscope, and that, in examining with the ocular, each hundreth of a millimetre of the first is magnified so as to cover three divisions of the second, we learn that the microscope magnifies 300 times.

The following method, which is but a slight modification of that proposed by M. Robin, has been adopted by the writer. It presents the advantage of great simplicity, and requires the use of only one micrometer, and with a little practice will enable the young microscopist to make himself acquainted with the powers of the several object-glasses and eye-pieces he may chance to possess; a knowledge which it is the more necessary he should be able to procure for himself, as almost all the instruments in use and on sale in this city are unprovided with any scale or registered description of the powers of the several glasses. It will be necessary in all instances to possess an objective or stage micrometer, whose subdivisions are known; with this, an ordinary eye-piece, and one of the circular glass slips used for covering objects, we are in possession of abundant means for estimating the powers of the various object-glasses; and if a little care be used in the manipulation, a very considerable degree of accuracy may be obtained. The circular glass slip may be extemporaneously converted into an ocular micrometer, by marking off on it, from a rule, with a diamond, or a finely pointed pen, any of the smaller subdivisions of an inch. Thus marked, it may be passed into the eye-piece by unscrewing the ocular, and be allowed to rest on the stop or diaphragm; the ocular being now replaced, we proceed to ascertain its power, and the consequently increased dimensions of the divisions of the glass slip, which may be done in the ordinary way, by looking at them with one eye, while the other is thrown on the subdivisions of a rule. These interspaces, being large, are

(*a*) See his Treatise on the Microscope, pp. 134, 135, *et seq.*

easily compared, and being superposed one on the other, as above described, the magnifying power of the ocular is thus obtained. If the objective micrometer be now brought into focus, we can easily see how many of its subdivisions correspond to one or more of the spaces which we have marked off, and the power of the object-glass is thus readily found.

For low power, and the comparison of tolerably large divisions of the micrometer and the rule, no difficulty will be experienced in ascertaining the magnifying number of a particular object or eye-glass, by the *method of superposition*, or that of looking with one eye through the microscope, and with the other at a rule, and at most only a few trials will be necessary in order to attain very considerable accuracy; but it will be found widely different when we come to deal with high powers and small divisions, and hence the value of M. Robin's method, and the modification of it just proposed, in which, though the preliminary step is made by ascertaining the power of the ocular by the method of double vision, another and certainly a more accurate process is employed for estimating the power of the object-glasses, which necessitates the comparison of minute subdivisions, in which, of course, any error would be less likely of detection. As to any source of error which might possibly arise from placing a slip of glass between the ocular and field-glass of the eye-piece, it must be so very trifling as not to deserve any notice. By selecting a glass whose surfaces are neither convex nor concave, but as nearly as possible flat, the amount of deviation will be altogether inconsiderable.

By a reference to the tables given in the works of Robin and Quekett, it will be seen that the number 800 represents the highest magnifying power which has been obtained for the object-glass by Nachet, a distinguished optician of Paris. In this, no account is made of the influence of the eye-glass, which would, of course, add considerably to the power. While with the $\frac{1}{12}$th inch object-glass, and the eye-glass A, manufactured by Ross, of London, a magnifying power of 600 is obtained; the same object-glass, giving with this maker's eye-glasses B and C, respectively, 870 and 1400, as the magnifying powers.

With powers far lower than these, however, many of the most useful and interesting investigations can be made. "The magnifying powers from 100 to 300," says M. Robin, "serve for studying the bones, the teeth, the hairs, the hair-bulbs, and the glandular culs-de-sac, but only in what concerns their grouping in each *acinus:* the study of their epithelium demands higher object-glasses." We think, however, that this author has elsewhere over-estimated the value of the very high powers, and also the facility of recognising by their aid, and distinguishing the several varieties of abnormal formation:—"La prétendue impossibilité de distinguer les globules de pus, des globules blanc du sang, des corpuscules du tubercule et une foule d'autres erreurs, tiennent à la même cause (les faibles grossissements)."—p. 172.

We shall next proceed to the consideration of some of the more recent contributions to NORMAL HISTOLOGY.

Development of the Anatomical Elements in General.—The following table has been constructed by M. Robin, to show the several relations existing between cells, which he considers the most simple, and least *animal* elements.

1. In the Ovum. Elements of transitory tissues or *embryonal cells*, formed by *segmentation* of the vitellus, whence results the birth of the embryo, and which terminate

A. In Vegetables. All by direct metamorphosis into elements of definite tissues, persisting thus in the state of cellule during the entire existence of the being.

B. Amongst Animals. *a.* Those of the superficial layer of the serous lamina of the blastoderma solely become metamorphosed, after the manner of vegetable cells, into elements of products (cells of the amnios, epithelial cells, &c).

b. All other embryonal cells terminate by dissolution.

2. In the Tissues of the fully formed Being. Elements of tissues which persist during the entire life of the individual, whence results its growth. They grow:

A. In Vegetables. In the state of cellules, being formed by germination, and undergoing metamorphosis as in the embryo. They terminate at the death of the being, or by reabsorption during life.

B. In Animals. *a.* The elements of *products* (epithelium, &c.) grow in the state of cells, undergoing a direct metamorphosis into *horn*, *nails*, and other products, in a manner similar to all corresponding embryonal animal cells and all vegetable cells. They terminate by desiccation, and fall off only at death.

b. The elements of fundamental *tissues* (muscles, skin, &c.), or the tissues properly so called, grow without passing through the state of cell, and without undergoing metamorphosis; they grow in the blastema resulting from the dissolution of embryonal cells, or in that which transudes from the vessels. They terminate either in death or resorption.

The formation of a nucleus on a pre-existing nucleolus is, according to Günsburg, a very rare occurrence. The nucleoli appear for the first time in the nuclei, after the action of acetic acid; and their independent origin first takes place with the formation of the cell from the nucleus. The well-known granular appearance of animal cells is first observed, as Kölliker remarks, on the addition of water; in their recent condition, the most of them contain, instead of a nucleolus, only a clear fluid. Kramer considers the nucleus of the blood-corpuscles of the frog to originate in the finely granular residue of the cell-contents, the yolk-granules, which collect together in a heap in the middle of the cell, and thus melt down into the clear-edged nucleus. From this author's history of the development of the frog, and the embryo, Henlé deduces the following interesting observations on cell-genesis in general. The

vesicles scattered through the yolk of the egg, which, as Vogt has discovered in alytes, originate in the germinal vesicle, form themselves from its granular contents. The granules of the latter, of the size of the human blood-copuscle, unite together in masses of three to four, at first, to which afterwards more are added, and, being thus of greater circumference, become surrounded with a clear membrane. The author calls the bodies thus formed, cells, and the granular heaps enclosed in them nuclei. The latter disappear in part after the formation of the membrane. At the period of segmentation, when the yoke has assumed the so-called blackberry form, from two to four of these vesicles are enclosed in the spherical bodies of which the yolk consists. He considers these bodies as supplied with an outer membrane, on account of their elasticity, by which, after alteration of their form from pressure, their former figure returns again. This membrane he believes to have demonstrated by treating the spherical bodies with water; but his description of them agrees very much with the well-known characters of albuminous globules, which may be observed scattered through water in the examination of many animal tissues.

Perty establishes a subdivision of ciliæ into automatic and voluntary, the one kind, proper to the higher animals, endowed with a constant movement, which always takes place in the same direction, the other constituting the locomotive apparatus of lower animals, moved by a physical impulse. Amongst these vibratile threads, which are known as the long, undulating locomotive organs of the infusoria, and the sporules of the algæ, this author places the tails of the spermatozoa(*a*).

Adipose Vesicles.—As far as regards the development of adipose vesicles, they are not, in the opinion of M. Robin, formed by metamorphosis of embryonal cells; on the contrary, it is only in the last periods of their development that they assume the form of vesicle, which is thus, in place of their first, their last state of evolution. They are first formed of three or four oil-drops, having each a diameter of about $0^{mm}\cdot004$, grouped side by side. The volume of each of these groups augments little by little, by the formation of new drops alongside the first; and it is only when the mass attains the volume of an adipose vesicle ($0^{mm}\cdot940$ or $0^{mm}\cdot050$), that a membrane is formed around the drops, which little by little unite into a single oily mass. They commence to appear about the fiftieth or sixtieth day, but the length of time occupied in their formation is unknown. Thus the mode of general formation of adipose vesicles is not precisely analogous to that of cells, properly so called. This formation commences long after the disappearance of the embryonal cells, and it does not differ from the mode of formation of the other elements of the constituent tissues(*b*).

(*a*) Leistungen in der Histologie, Von Henle; Canstatt's Jahresbericht der Medecin, erster band, p. 27, *et seq.* Erlangen, 1849.

(*b*) *Vide* Compte rendu des Séances de la Société de Biologie pendant le Mois de Decembre, par M. Segond, Secretaire; Gazette Médicale de Paris, No. 9, Mars 2, 1850, p. 168.

Development of Cartilage.—Professor Meyer, of Zurich, has published a long and interesting memoir on the transformations which cartilage undergoes. This author concludes, from the result of his observations, that cartilage is but a transition, a step which must lead to products more advanced and better defined; that there does not exist a permanent cartilage, and that this substance must be regarded as in progress of development, and destined to pass into an osseous or a fibrous mass, or to disappear by softening. The *cartilage cell*, while young, is small, encloses a nucleus which is distinguished with difficulty, and a grumous fluid. It may be round, angular, or fusiform, and when completely formed, can give birth to other cells. The number of cells which the cartilage contains at its origin does not appear capable of augmentation, except by the development of mother cells. The growth of this substance, therefore, is due to the increase of the intermediate substance (hyaline of authors), at first existing only in small quantity, as well as to the enlargement of the mother cells, which extend themselves in proportion as new ones are formed within them. In the progress of ossification, the inter-cellular substance, after it has remained for a time homogeneous, becomes ossified by the deposit of calcareous salts in large or small grains. The second process, transformation into fibrous tissue, may sometimes precede the first, but can never follow it. The cellule must have attained its full development before it becomes ossified ; its thickened envelope then becomes impregnated with calcareous salts, and thus constitutes the wall of an osseous cell. When, on the contrary, ossification commences before the cell envelope has increased in volume, the salts are deposited on its entire surface, or fill all its cavity(*a*).

New species of Anatomical Elements which are found in the Medullary Canal of Bones.—Under this head M. Robin has laid a communication before the Society of Biology, in which he has pointed out the existence of two histological elements of bone, hitherto undescribed. He says

1st. There exists in all bones, short, flat, or long, besides the adipose cells, the vessels, and the finely granular amorphous matter, a particular kind of cells, which may be called *medullary cells*, because they are proper to the medullary tissue of the bones. They are either spherical or a little polyhedral, have a diameter of $0^{mm}\cdot015$, to $0^{mm}\cdot018$; they are transparent, with sharp borders; they all enclose a nucleus, which is spherical, regular, transparent, and with a well-defined border, having a diameter of $0^{mm}\cdot006$ to $0^{mm}\cdot007$. Between the nucleus and the cell wall exist granules and molecules which vary in quantity, but are constant. These cells are more abundant in the young subject than in adults, constituting in the former, with the vessels, almost the entire of the marrow of the bones.

(*a*) Müller, Archiv. für Anatomie und Physiol, t. iv. 1849; *vide* Archives Générales de Médecine, t. xxiii. p. 64, Mai, 1850.

2nd. In the long bones, as well as in the short, but in smaller quantity in the latter, may be found another species of anatomical element, which it is more important to recognise than the preceding, because it sometimes constitutes, by itself alone, certain bony tumours. Some tumours of bone, considered by pathologists as cancerous, enclose, not cancer cells, but a special element, characterized by large plates or flattened lamellæ, sometimes polygonal, sometimes irregularly spherical, having a diameter of at least $0^{mm}\cdot050$ to $0^{mm}\cdot080$. These plates are finely granular, and are remarkable by their nuclei, which are from six to ten in number, contained in the thickness of the plates, and giving them a character at once special and easily recognizable. These nuclei are $0^{mm}\cdot009$ in length, and $0^{mm}\cdot005$ in width; they are ovoid, and contain one or two nucleoli, accompanied by little molecular granulations. M. Robin has had occasion to examine many tumours of this kind, which constituted *spina ventosa* of the tibia. M. Lebert and M. Vosse (of Christiana) have also met with specimens.

In the opinion of M. Robin, however, these bodies constitute normal elements of the medullary tissue of bone. They may be found in greatest abundance between the external surface of the marrow and the internal face of the canal. They are much less numerous than the cells first described, or than the adipose vesicles, and are more abundant in the bones of young subjects than in those of adults or old men. Both species of elements exist in the bones of all the domestic mammalia. It is by the local growth, in great abundance, of these lamellæ, that certain tumours, hitherto considered cancerous, are formed(*a*).

On the Structure of an Epulis of the Inferior Maxillary Bone.— At a subsequent meeting of the Society of Biology, M. Robin presented a tumour of the size of a little nut, which had led to the removal of a part of the inferior maxilla, from the belief that the disease was cancerous, but which in reality presented none of the succus characteristic (?) of this degeneration. On examining a portion of the tissues of the surface of this tumour, M. M. Robin and Dionis found in it the *polynucleated plates* above described as constituting, in the opinion of the former of these observers, normal elements of the marrow of bone. From the result of this examination they diagnosed that the disease took its origin in the osseous tissue of the maxilla, and not in the periosteum as first supposed. A section of the tumour showed in fact that it originated in the bone, and had engaged half its thickness. There was no cancerous element; the morbid tissue was exclusively formed of the following homœomorphous elements:—1st, very numerous polynucleated plates; 2nd, fibro-plastic elements (nuclei and fusiform fibres of Lebert); 3rd, cellular tissue; 4th, capillary vessels and molecular granules. The greater number of the tumours known under the name of epulis, says

(*a*) Societe de Biologie; *vide* Gazette Médicale, No. 51, p. 992, Dec. 22, 1849.

M. Robin, consist of the polynucleated plates and fibro-plastic elements, and spring from the bone: others originate in the periosteum, and are purely fibrous and fibro-plastic. The one and the other are consequently homœomorphous. In like manner various tumours of the tibia, the femur, &c., growing either from the compact tissue, or from the medullary canal, and which are often taken for examples of cancer(*a*), are homœomorphous, and consist principally of the polynucleated plates.

Structure of the voluntary Muscular Fibre, and of the Heart, in the different Classes of Animals.—An important memoir has been published on this subject by M. Lebert, from which we are induced to make a somewhat lengthened extract, as both the name of the author and the nature of the subject warrant us in regarding it as of the very first interest in transcendental histology. In this department of medical science M. Lebert is already distinguished by his researches on the formation of the heart, which were conducted with the assistance of M. Prevost, the late illustrious physiologist of Geneva, and published in the Annales des Sciences Naturelles.

In the opinion of M. Lebert, four different stages may be observed which the voluntary muscular fibre passes through in an ascending scale, before we arrive at the complete texture of the tissue, which, by its contractions, executes the functions of locomotion.

The first stage is that of *motility*, without muscular fibre. In this condition all the envelope of the body of an animal can contract, enlarge, and even execute active movements of progression and natation, without our being able to detect the presence of fibres, granules, striæ, or cylinders, which even the strongest magnifying powers fail to show under the microscope. Here we have movements analogous to those observed under other circumstances, in animal and vegetable bodies; such are the vibratile ciliæ of the epithelium on the surface of the body of many embryos, and the movements of the spermatic threads, which, in the opinion of M. Lebert, *have been so long wrongly regarded as animalcules.* Something analogous is met with in the autonomic movements of the sporules of the algæ.

Thus at the bottom of the animal scale are found the general properties, which, however, are subject to remarkable modifications, but yet this tissue wants a special molecular base. This first stage of muscular development may be termed the *anhystic tissue of spontaneous movement.* It is met with in all the class of infusory animalcules, properly so called, in many polypes, helminthides of the class of cystoides, and of some inferior neumatoides.

The second stage of muscularity is that in which the fibre is found imbedded in the transparent intermediary substance. These fibres, without forming bundles, are, however, disposed so as to constitute muscular planes, sometimes superposed in parallel layers,

(*a*) Gazette Médicale de Paris, No. 13, Mars 30, p. 251.

sometimes crossing at right angles, and forming around the different apertures of the body circular layers, which can effect alternately their closure and dilatation. This may be denominated the *fibrous or fibrillar tissue of spontaneous movement.* It is to be found in the polypes, annelidæ, and many mollusca.

The third degree of evolution of muscular movement is that where the fibres are grouped so as to form cylinders, or fascicculi, and where the muscular planes give place to true muscles, more and more different from everything that surrounds them. This, which may be called the *cylindrical muscular tissue,* obtains very generally among the mollusca and the annelidæ.

The fourth degree is the most perfect, and such as we find it in the muscles of voluntary motion from the mollusca to the highest vertebrata. It is to be observed, however, that no very accurate limits exist, and that this, the fourth degree, may be found amongst certain polypes, acalephæ, &c. As, in the nerve, the primitive nervous tube is the last essential element of the apparatus of innervation, so the muscular cylinder is its analogue as regards the functions of voluntary motion. The term *primitive cylinder* is given to all that portion of the muscular tissue which is clearly defined in all its circumference, or which under the microscope shows two longitudinal contours, much more clearly marked and isolated than the longitudinal fibres of the interior cylinders, which are mostly furnished with transverse folds on their surface. These cylinders, long, parallel, and flattened from before backwards, are united and grouped to form muscular fascicculi. In their manner of grouping there is something peculiar which cannot be too well studied. They are united together, to the number of four, five, or upwards, into secondary cylinders, which are often furnished with common transverse folds, in addition to those possessed by the cylinders within. The muscular cylinder is, therefore, composed of a surface with its transverse folds, and an interior, containing the primitive fibres, with their fibrillar and inter-fibrillar molecular granules. The surface, as before remarked, is usually furnished with transverse striæ, to which with justice a sufficiently great importance is attributed. These striæ, however, will be found wanting in the muscular substance of the heart in many of the superior animals, and even in some of the muscles of voluntary motion in very young vertebrata. These striæ are constituted by rounded slightly elevated folds, which pass around the flattened cylinder, without communicating one with another like the curves of a spiral. They are not the accidental results of relaxation or contraction, but are permanent. They may, however, be seen more or less near, distant, or distended, according as the cylinder is relaxed, contracted, or distended. To these variations of distance corresponds their appearance as a single or double line. *They do not at all traverse the entire thickness of the cylinder*, and consequently do not transform it into a pile of disks, as has been supposed by some. The internal surface of the cylinder is united to the intermediary semi-transparent substance,

which binds together the primitive fibres. These latter are very fine, either alternately opaque or transparent thoroughout; and the granules, thus distributed in their interior, sometimes show still much transparence in their centre when they are examined with high powers. Their juxtaposition in neighbouring fibres may simulate the appearance of the true transverse striæ.

All the constituent parts of the muscular fibre have been subjected to measurement by M. Lebert. The mean size of the primitive fibre varies between $0^{mm}\cdot001$, and $0^{mm}\cdot0015$; he has not observed them to exceed $0^{mm}\cdot002$. The size of the non-striated cylinder may vary between $0^{mm}\cdot004$, and $0^{mm}\cdot02$. The primitive cylinder of the striated muscles varies between $0^{mm}\cdot005$, and $0^{mm}\cdot1$. The size of the transverse striæ is between $0^{mm}\cdot001$, (simple linear) and $0^{mm}\cdot0025$.

The nutrition of the muscular fibre is in general effected by the nutritive transudation from the blood-vessels, the distribution of which in general follows the direction of the cylinders, in the interstices of which the capillaries are often lodged. Innervation of muscles is observed to take place by the distribution of the nervous terminations in the muscular substance. Wagner is of opinion that the fibrillæ of the nerves enter the very substance of the muscular cylinder, an opinion in which M. Lebert does not fully coincide, as he considers that it is certainly not their only mode of termination, he having himself observed numerous primitive nerve-tubes coursing along between the planes of muscular cylinders, and turning on themselves to constitute loops everywhere isolated.

The coloration of muscles depends evidently, according to the same authority, on a particular pigment, since they are met with of a red colour in animals with white blood, and white in animals with red blood(*a*),

The subject of the contraction of muscular fibre has long occupied the attention of the physiologist; but as it belongs more especially to the department of *physiological physics*, we cannot at present enter into the consideration of the many important contributions which have been lately made to it, particularly by the German school. In Canstatt's Jahresbericht, and the more recent numbers of Henle and Pfeufer's Zeitschrift für Rationelle Medicin, will be found many interesting papers on this subject.

Structure of the Uterus.—Under this head a long memoir(*b*) has appeared from the pen of Dr. Franz M. Kilian. His observations have been conducted on a very extensive scale, and for the purpose of following up the development of the organ from its earliest stages, very young animals have been selected. A very close investigation has been made into the structure of its serous covering, which appears to consist of a hyaline or structureless membrane, with nuclei imbedded in it. The nuclear-formation (*die kernbildungen*) appears

(*a*) Gazette Médicale, No. 49, p. 938, Dec. 8, 1849.
(*b*) Zeitschrift für Rationelle Medicin, viii. band., i. & ii. heft, p. 53; ix. band., i. heft, p. 1. Heidelberg, 1849.

to present certain modifications: some of the nuclei are small, round, naked, and without nucleoli (earliest stage); others larger, of a vesicular form, containing one, two, or more nucleoli. A third kind may be observed with granular contents, and either with or without nucleoli. Besides the round or oval nuclei just described, others will be found fusiform, elongated, and, in many instances, presenting fibrous prolongations, some of which bifurcate, and unite with the fibres of neighbouring nuclei, forming a close network. On their interior the walls of the uterus are coated with a thick layer of epithelium, or naked granular nuclei. The substance of the mucous membrane contains a quantity of utricular glands, for the most part rectilinear in direction, and bound together by a fine cellular tissue; a few, however, may be observed of a spiral form. When the serous membrane is removed from a portion of the walls of the uterus, the proper texture of this organ is brought into view; it appears as a soft reddish mass, consisting of nuclei imbedded in a *glassy* gelatinous blastema.

In the lithographic drawings which accompany Dr. Kilian's paper will be found excellent delineations of the above described elements, as well as of many others which want of space alone prevents us from describing in detail. Indeed the whole investigation appears to have been prosecuted by the author with that untiring and energetic spirit of research which is so characteristic of all the observers of the German school, and to which medical science is so deeply indebted, notwithstanding all the imputations that ignorance and unfounded prejudice have heaped on labours which are invariably characterized by profound and erudite research, and philosophic minuteness.

Glands of the Alimentary Canal.—Professor Thompson, in a communication to the Annals of Anatomy and Physiology, proposes the following classification of the glands occurring in the alimentary canal, which he thinks may be all placed under the four following orders, admitting of ten subdivisions.

I. Vesicular; composed of entire vesicles (or small bladders), usually closed.
  1. Aggregated glands of Peyer in the small intestine.
  2. Solitary ditto.
  3. An occasional state of the next mentioned glands.

II. Follicular; forming small bags or cavities, usually open pits.
  1. Of the large intestine; constant.
  2. Of the stomach; frequent, but not constant.

III. Tubular; composed of membranous tubes, closed at the remote ends, and usually simple.
  1. Of the small intestine; follicles of Lieberkühn.
  2. Of the large intestine.
  3. Of the stomach.

IV. Racemose; tubes simple or sacculated (and vesicles), arranged in clusters round a central stalk or duct.
  1. Cardiac-œsophageal.
  2. Duodenal of Brunner.

The author further considers that the columnar epithelium, which everywhere exists on the surface of the mucous membrane, extends for some way into the interior of the follicular, tubular, and racemose glands; but no true lining of this kind, different from their secreted contents, exists in the vesicular glands; these last he supposes to be rather a modification of parent secreting cells, than true glandular cavities.

The secreted product of all these glands, presenting to the naked eye the appearance of a greyish, grumous, semifluid mass, exhibits when viewed under the microscope, a variety of cells mixed with globules, granules, and molecules of various size. In the healthy tubular gastric glands the cells are, during the intervals of digestion, accumulated in considerable quantity in the tubes, so as to cause the membrane of the tubes to bulge out at somewhat irregular intervals, and thus to give them a sacculated appearance. These gastric cells are poured out in large quantity on the surface of the mucous membrane during digestion, and may also be frequently seen to exude anew after death, being united by imbibed water, so as to form a layer of substance indefinitely termed mucus, which has been often noticed covering the inner surface of the stomach. The microscopic examination of this layer sometimes affords a most interesting view of the gastric cells in all stages of development or decadence; smaller cells existing within the larger, to the second and third progeny; and thus very probably furnishing, as Frerichs suggests, the source of that ferment, or analogous matter, which, along with the acid ingredients of the gastric fluid, is essential to the solvent action of stomachal digestion(*a*).

Structure of the Spleen.—A very erudite paper, with many interesting original observations on the structure of this organ, will be found in the Annals of Anatomy, from the pen of Dr. Saunders. The author enters largely into the history of all previous research on this subject. We select the following enumeration of the different microscopical elements which the more recent observers consider to constitute this organ.

1st. Granular corpuscles (Gulliver, Henlé, Ecker, Simon, Sharpey). They are about the size of the red blood corpuscles, are sometimes of a reddish colour (Sharpey), and more or less irregular.

2nd. Caudate corpuscles (Sharpey, &c.), or fusiform cells.

3rd. Cells with nuclei more or less granular (Henlé), considered to be rare and accidental.

4th. Yellow-coloured pustules, cells, or corpuscles (Hanfield, Jones), contain blood-globules (Ecker, Kölliker).

It is a general opinion that the spleen consists of nuclei or cy-

(*a*) On the Structure of the Glands of the Alimentary Canal, by Allen Thompson, M. D., &c., Professor of Anatomy in the University of Glasgow; Goodsir's Annals of Anatomy and Physiology, No. i. p. 33, *et seq.* We regret being unable to give the entire of this interesting memoir, which is accompanied by very excellent lithographic drawings.

toblasts, which never reach the higher development of the nucleated cell (Simon, Jones, &c.)

5th. A homogeneous membrane around the Malpighian glandulæ is denied by most observers (Henle, Oesterlen, Simon, &c.) It has been stated to exist by Ecker; but as he demonstrated it by the application of potassa, which dissolves animal textures into a homogeneous matter, this observation is uncertain.

6th. Muscular fibres of the involuntary kind, and differing in different animals, have been described by Kölliker in the proper membrane and trabeculæ of the spleen.

From the result of his own observations, Dr. Saunders concludes that the Malpighian body consists of a hollow sphere, formed by, 1st, externally, a fibrous membrane containing blood-vessels, and attached by a vascular pedicle; 2nd, internally, a granular membrane, the internal surface of which is lined by a layer of large nucleated cells, while free nuclei or corpuscles with a homogeneous or granular plasma fill its interior. It is a closed sac containing secreting elements.

The Pulp or Parenchyma of the Spleen is distinguished under the microscope by a peculiar brown colour, even after the blood disks have been completely washed away. We may observe in it corpuscles and granules, with a few granular cells, coloured particles, red or yellow, of a crystalline appearance; peculiar fusiform or spindle-shaped cells, which are placed in a semimembranous plasma(*a*), intersected by a capillary plexus, and crossed by bands of trabeculæ. The corpuscles of the pulp resemble the saccular corpuscles, in being pretty nearly of the same size, in being hollow, nearly circular, translucent, and in containing several granules in their interior. The entire of this paper will be found worth consulting by those who may be interested in the study of this organ.

In the foregoing pages we have noticed but a few of the many important additions which have been made to normal histology since the publication of the systematic works of Mandl, Donné, Vogel, and others. We shall next proceed to consider briefly some of the more recent observations in Pathological Histology.

New Products consist entirely, according to Günsburg, of elements which are identical with those of the normally developed tissues, in appearance, form, and mode of development. These elements are cells and fibres. The well-known division into homologous and heterologous tissues is, in the opinion of this observer, not in accordance with pathological experience. In fact, if a close examination of pathological cells or fibres be instituted, there may always be observed in them a tendency to *raise* themselves to normal formations of known form.

All that is produced by disease is under the normal form which appertains to health. It may, therefore, be stated, in accordance

(*a*) On the Structure of the Spleen, by William B. Saunders, M. D., Edinburgh; Goodsir's Annals, No. i. p. 49, *et seq.*

with this doctrine, *that pathological cells are identical in their development with normal cells.*

The material from which pathological cells are developed is the blood serum, and is therefore identical with the medium of general nutrition, and consequently possesses a proper capacity for assuming definite form (*gestaltungfähigkeit*). The disposition of the cytoblastema to cell-formation is not a purely chemical act. The difference in form of pathological growths is to be attributed to, 1st, the difference of the blastema; and 2nd, the difference of the *locus* of formation. The difference of blastema influences the configuration of cells by its chemical qualities; experience shows that the highest form of cell stands in relation to the quality of the fibrine of the blood. The formation of cells may take place under different conditions. As arrests of development the following are given as examples by this author.

1st. Arrest of development of cells at the formation of nuclei.

2nd. The imperfect development of the nucleus after the full growth of the cell.

3rd. When the cell remains in its condition of full development.

Excessive growth is observed—

1st. When the cells are accompanied by an immoderate nuclear formation.

2nd. When they pass into fibres.

3rd. When the cells pass into a tissue similar to that of the parent structure.

Of cells arrested in the stage of nuclear formation, Günsburg regards tubercle as an example. The typhic product he considers as an instance of cell-formation with imperfect nuclear development; while the cancer-cell is looked upon as the highest grade of individual cell-formation, though it does not possess the faculty of undergoing a greater development(*a*).

According to Bock, *new formations* are either of an organic or an inorganic nature. The former follow the laws of formation of organic life, and reach sometimes a higher, sometimes a lower degree of evolution, constituting, when they attain the highest grade, a normal tissue; the latter are developed in obedience to the laws of pure chemistry, and the most perfect form they are capable of attaining is that of a crystal. Both kinds of new formation can pass into each other, and can even exist together. The organized new products contain the protein-compounds and fat; they form fibres and cells. This author makes a further division into homœoplastic and heteroplastic. The stroma which is observed in many growths may be either structureless or fibrous, sieve-like or forming a network, and the following varieties will be found in different formations:—1st, a fluid stroma, with granules, nuclei, and cells, which differ essentially from the normal; 2nd, a fluid or semi-fluid stroma,

(*a*) Leistungen in der Pathologischen Anatomie, Von Albers. Canstatt's Jahresbericht, Zweiter Band, p. 37, Erlangen, 1849.

with fibrous cells adhering to each other, or united at their extremities; 3rd, a fibrous stroma with cells; 4th, a fibroid or callous tissue; 5th, a tissue exactly analogous to the true physiological, and either with or without a vascular formation.

The pus corpuscle is regarded by Günsburg as a cell which, by the excessive development of nuclei and its consequent breaking down, is prevented from reaching a higher stage. This view, as remarked by Albers, is altogether new. In this department much yet remains to be done before we shall be in a position to appreciate the value of particular form and size, and the absence or presence of nuclei and nucleoli in cells. It must be evident to the most superficial observer, that a certain relation exists between the complexity of arrangement of the particles of any morbid growth, and its period of development, as also its position in any scale which expresses the comparative organization of different pathological products.

The breaking up of cellular and fibrous tissue into molecular particles, and their passage into their organized and unorganized constituents, is the last act in the process of organic transformation. The nucleus will be observed to pass into granules, pigment, or fat; the fibre gives way in layers, becomes varicose, and covered with adherent molecular fragments. The inorganic particles, in obedience to chemical affinity, group themselves into small adherent masses, or become crystallized(*a*).

Development of Pathological Cysts.—An extensive memoir on this subject, by Dr. Carl Bruch, will be found in Henle and Pfeufer's Zeitschrift. From an examination of the facts adduced, this author concludes that the following phases may be observed in pathological cyst formations. An effusion of fluid which may be serum, blood, colloid matter, or an exudation destined to become pus, takes place into tissues of either normal or pathological origin; the surrounding cellular tissue becomes thickened by pressure and extension, or by the help of the coagulable nature of the effused fluid. A simple cyst is thus formed, whose walls, in course of time, become smooth, and invested with an epithelium. In these walls new cysts are formed in a precisely similar manner, which increase in size, and in their growth encroach on one another so as to become united. From the walls of these cysts, when existing in extensive organized pathological products, differently formed growths will be found to spring, which more or less fill up their cavities. And thus, if in a fibrous tumour solitary interspaces are found, it constitutes the *simple cystosarcoma;* other modifications being respectively the *Cystosarcoma phylloides*, and *C. proliferum* of Müller(*b*).

Pathological Pigmentary Matter.—The variations in colour observed in diseased organs and tissues depend, according to Virchow, on the number and state of fulness of the blood-vessels, and the

(*a*) Jahresbericht, *loc. cit.*
(*b*) Zeitschrift für Rationelle Medicin, band. viii. p. 91, Heidelberg, 1849.

thickness and molecular arrangement of the tissues, and their influence on light, or on the presence of colouring matters within the organs and tissues. These colouring matters are, in general, of three kinds: coloured fat, changed or unchanged biliary matter (cholepyrrhin), and hæmatin. This last, which is capable of becoming extravasated from the blood-corpuscles, and may then undergo various changes, appears to be a very frequent constituent of the different pathological pigments. It may be observed in the stroma of many tissues as large irregular masses, sometimes circular, but more generally angular and pointed; at other times it will be found as a small powder, not unlike the ordinary uric acid sediment. The circumference of the little bodies is generally very sharp and dark, their surfaces brilliant and lustrous, which shows their thickness. In some instances they will be observed perfectly crystallized; the crystals vary in thickness, and under the microscope may be observed either of a tabular form or as rhombs; their colour is either brick-red, a golden yellow, or a deep ruby; they may be found free, in masses, or even inclosed in cells. Virchow has repeatedly met with them in cicatrices, imbedded in a thick layer of elastic fibres; they have been also observed in the Graafian vesicles, the brain, the skin, the spleen, and in the joints(*a*).

Epithelial Tumour.—Ecker has called attention to a class of tumours of the lip, which he has distinguished by the name of bastard cancer of the lip (cancroid growth, Bennett). It is believed at present that the seat of these tumours is not limited to the skin, but that they occur also on the mucous membrane. Rokitansky has found them on the mucous membrane of the larynx, the trachea, the stomach, the intestines, and the bladder; Küss has seen them on the dorsal aspect of the hand: they may be met with on the cheeks, the lips, the prepuce, the scrotum, and it is probable that the chimney-sweep's cancer is but an epithelial tumour. It is also pretty generally considered that these tumours are not of a malignant nature; Lebert regards them as benign, because they contain no cancerous globule; Sédillot is of the same opinion, as they do not exhibit fibrous or cancerous cellules. Rokitansky and Bruck, however, do not agree in these opinions. The most important question concerning them, in the opinion of Dr. Gorup-Bezanes, and which he has attempted to resolve by a series of observations, is, not whether these tumours may be benign, but whether they are altogether exempt from malignity. Three cases reported by this author give the following results.

First observation.—Rapid development of tumour in less than a year, ulceration, ichorous suppuration, pains; re-appearance six months after extirpation, with characters still more menacing. The tumour ulcerates; the subjacent bone is attacked to the extent of two inches; the roots of the teeth are laid bare.

Second observation.—Indolent ulceration, slow progress until exciting means were adopted.

(*a*) Jahresbericht, *l. c. cit.*

Third observation.—Ulceration, pain, rapid progress; return six weeks after operation, with pain; cachectic aspect; new operation, to which succeeded a tumour of the neck.

These examples suffice to show that the too generally received opinion, as to the non-malignity of these tumours, is unfounded, and that they may exhibit characters of the greatest malignity(*a*).

In the fourth volume of the Jahresbericht der Medicin will be found a most extensive and able report on the subject of tumours, both benign and malignant, by Professor Albers, of Bonn. The opinions of the most able micrographers as to the possibility of arriving at a diagnosis of cancer from histological characters are considered at length, but we are unable to do more than allude to the publication of this report. We would also particularly call attention to the article on cancer and hypertrophy of the stomach and pylorus, by Dr. Carl Bruch, of Heidelberg, to which an entire number of Henle and Pfeufer's Zeitschrift is devoted (viii. Band. iii. Heft, 1849).

With these few notices of contributions to pathological histology, we are compelled at present to close our Retrospect. To do full justice to the subject would have demanded considerably more space than we have been able to command in the present Number. We hope, however, to be enabled at some early opportunity to return to the subject. Of the value which we attach to this department of research some evidence will be found in the introductory remarks of this article, and we sincerely trust that our predictions with regard to the cultivation of this branch of medical science in the Irish school will not prove unfounded. In the schools of London and Edinburgh not a few medical men have risen to fame and eminence from the prosecution of this method of research, while amongst our continental brethren the study of the microscope has long occupied a prominent position in medicine, and proved highly conducive to the advancement of professional knowledge. May we in Ireland not be slow to follow such worthy examples.

(*a*) Archiv. fur Physiol. Heilkunde, 1849; *vide* Archives Generales de Médecine, t. xxiii. p. 76, Paris, Mai, 1850.